(No Model.)

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G. & A. RAYMOND.

MACHINE FOR REDUCING ORES, &c.

No. 315,338. Patented Apr. 7, 1885.

Fig. 1.

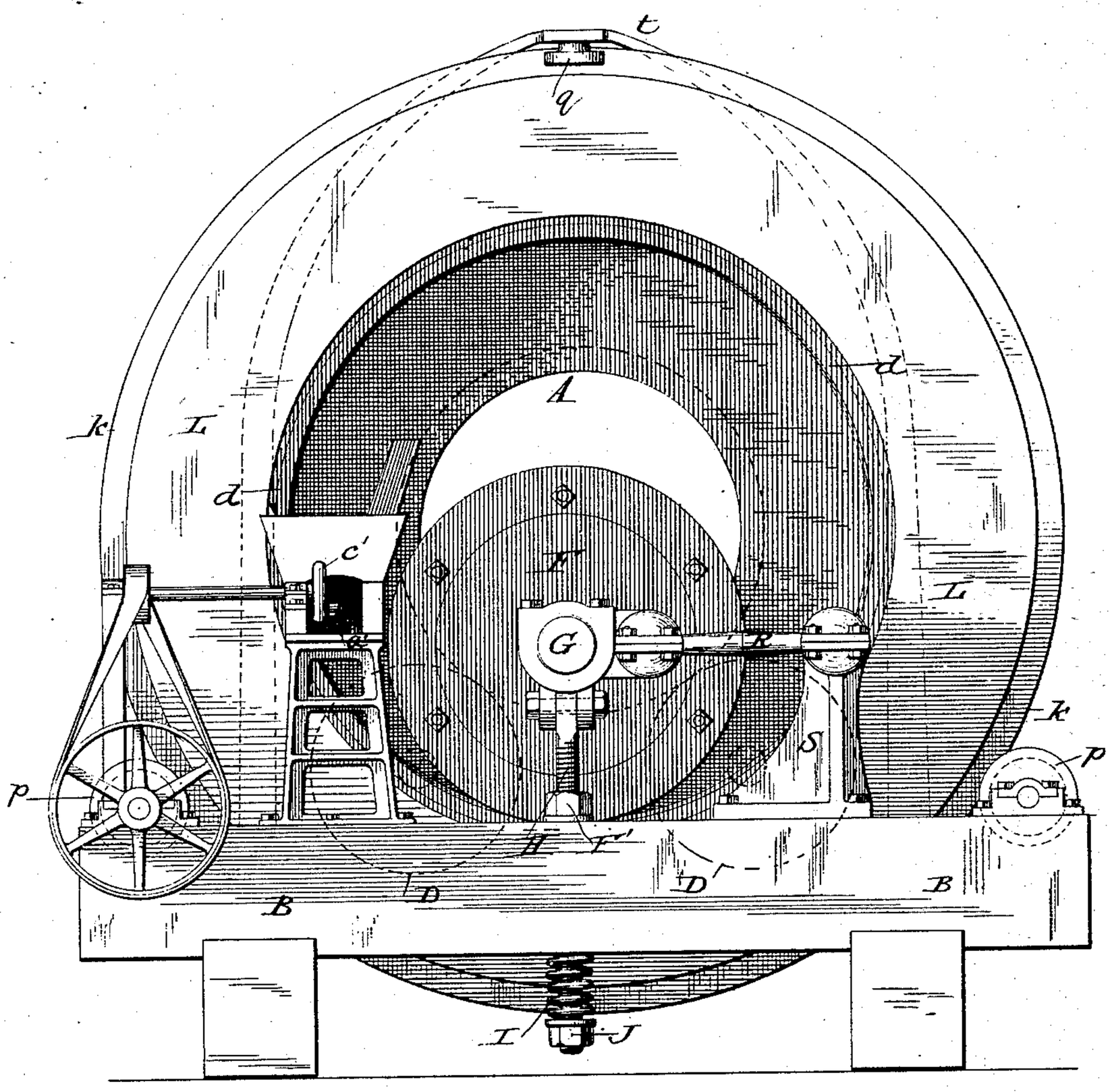
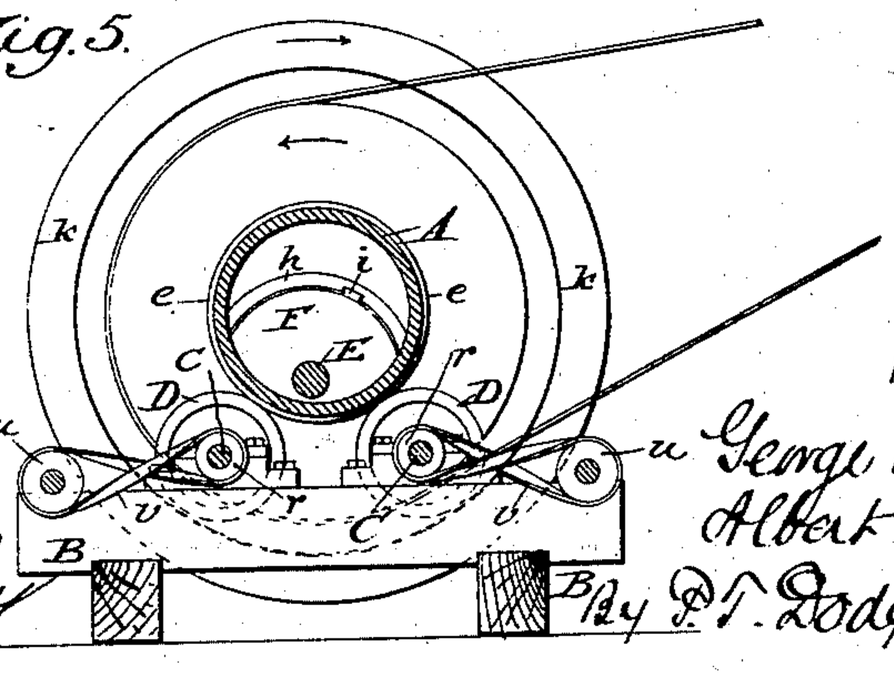


Fig. 5.



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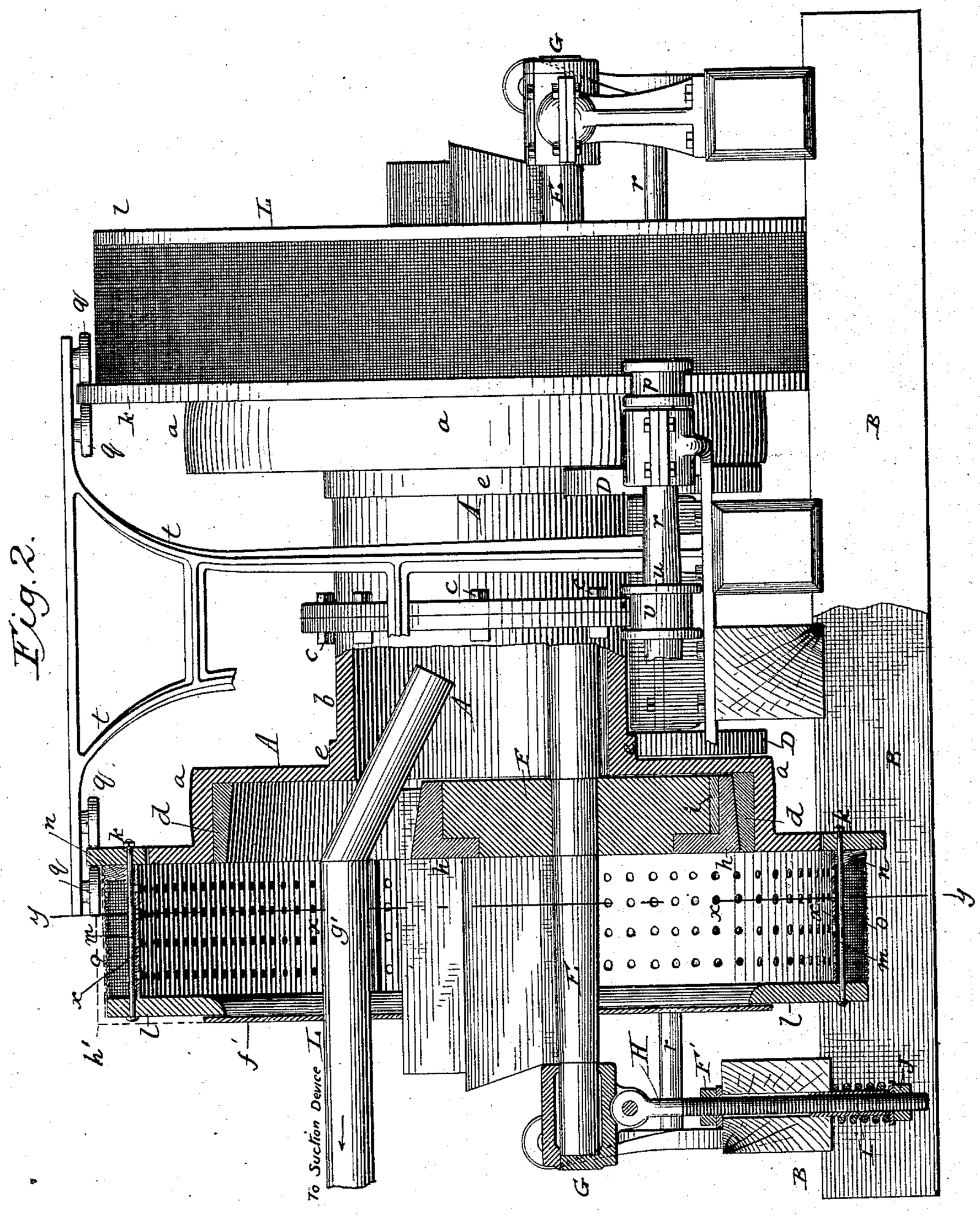

Fig. 2.

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Fig. 4.

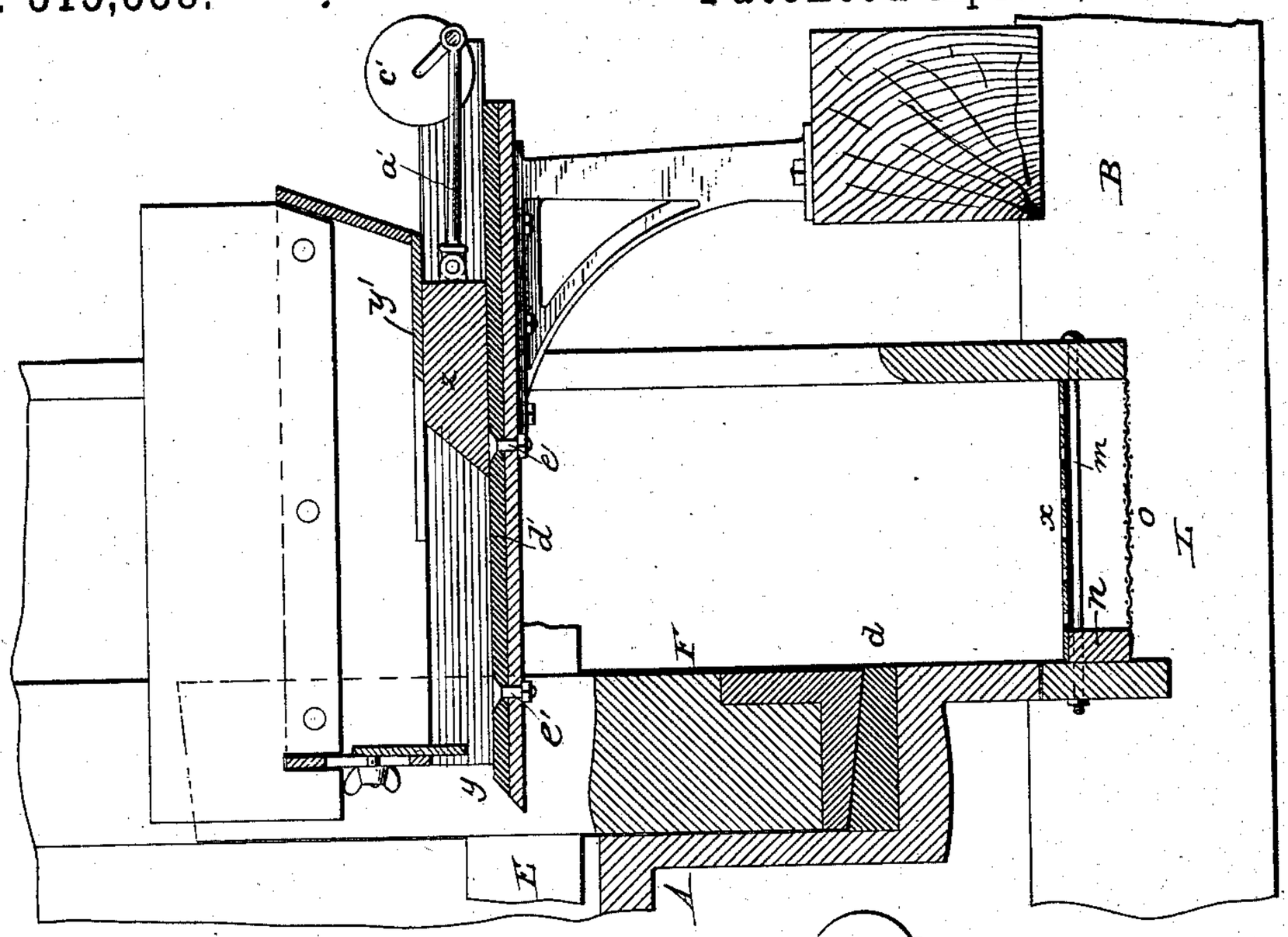

Fig. 3.
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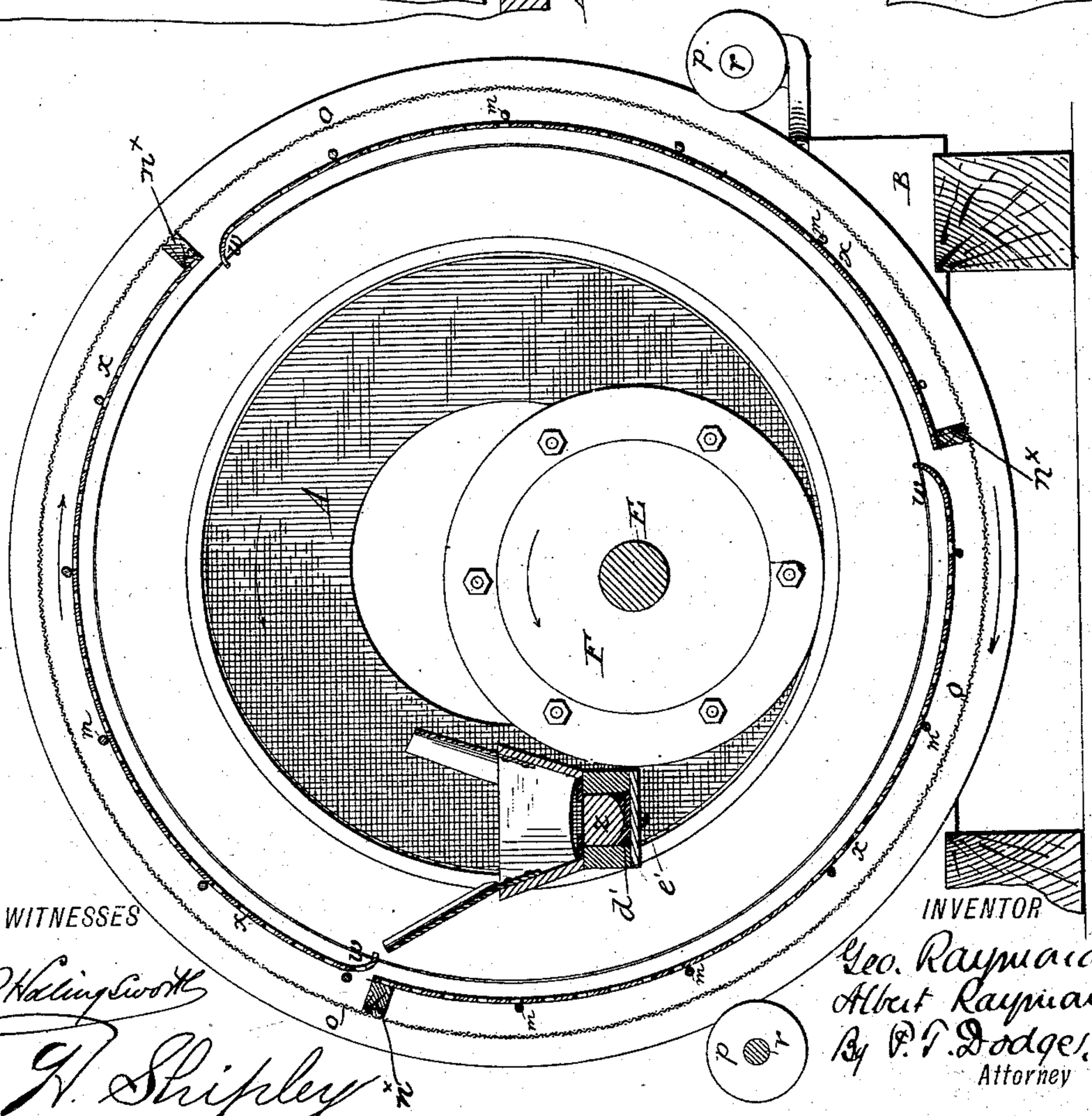

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UNITED STATES PATENT OFFICE.

GEORGE RAYMOND AND ALBERT RAYMOND, OF CHICAGO, ILLINOIS.

MACHINE FOR REDUCING ORES, &c.

SPECIFICATION forming part of Letters Patent No. 315,338, dated April 7, 1885.

Application filed May 26, 1884. (No model.)

To all whom it may concern:

Be it known that we, GEORGE RAYMOND and ALBERT RAYMOND, of Chicago, in the county of Cook and State of Illinois, have invented certain Improvements in Machines for Reducing Ores, &c., of which the following is a specification.

Referring to the accompanying drawings, Figure 1 represents an end elevation of our improved machine. Fig. 2 is a side elevation of the same, one end of which is a duplicate of the other, being represented in vertical section through the middle. Fig. 3 is a cross-section on the line *y y* of Fig. 2, illustrating the feed mechanism and grading-screens. Fig. 4 is a cross-section, on an enlarged scale, of the feed mechanism. Fig. 5 is a vertical cross-section through the middle of the machine, showing the driving-gear and other parts.

In proceeding to construct our machine we first provide a horizontal tubular body, A, consisting of two annular rings or flanges, *a*, of large size, connected by the intervening tubular portion *b* of relatively small size. It is preferred to construct this body in two equal parts flanged at the middle and united by means of bolts *c;* but the entire body may be cast in one piece, or it may be constructed of any desired number of sections. The circular ends or flanges *a* have their inner surfaces provided with a facing or lining, *d*, of chilled iron or other hard material adapted to resist the wear to which it is subjected. We prefer to cast the facings *d* each in the form of a continuous ring; but they may be composed of three or more sections joined end to end. The lining may be secured in position by bolts or other fastening devices; but it is preferred to fit them somewhat loosely within the flange and confine them in place by pouring lead, tin, or equivalent soft metal between their outer surfaces and the inner surfaces of the flanges *a*. This mode of attachment is at once cheap and reliable, and is advantageous in that it permits the facings to be readily removed and replaced by others when required. We construct the inner faces of the lining *d* in flaring or conical form—that is to say, we make the opening within the lining of increasing diameter toward the outer end of the body. This inclination of the inner surface, on which the reduction of the ore is effected, is important in that it secures an automatic delivery of the material from the machine as the reduction progresses. At or near each end of the body we form thereon a circumferential flange or track, *e*, which should be finished in a true circular form, in order that it may travel smoothly on the supporting-rolls. Having thus produced the machine, we next provide a base-frame, B, and mount thereon in suitable boxes or bearings, and on opposite sides, two horizontal shafts, C, each having two wheels, D, on opposite ends. These wheels, which are constructed with smooth peripheral surfaces, are designed to give support to the body A, which is seated upon and between the wheels, in the manner represented in full lines in Figs. 2 and 5, and by dotted lines in Fig. 1. By this arrangement of parts the body is given a firm and solid support at each end, but permitted to revolve with freedom.

Having placed the body in position, we next provide a horizontal shaft, E, of sufficient length to extend through the body from end to end and project at each side. On this shaft we secure two wheels or rolls, F, at such distance apart that when the shaft is inserted through the body, as shown in Fig. 2, the rolls will travel on the lower inner surfaces of the respective rings or surfaces *d*. Each of the wheels F is encircled by a ring or surface, *h*, of chilled iron or other exceedingly hard material, and finished on the periphery to a true circular form with a taper or bevel corresponding with that of the surface *d*. It is preferred to cast the chilled rings *h* upon soft-metal blocks *i*, previously placed in the mold in such position that they will project beyond the inner surface of the rings. These soft-metal blocks, which rest upon the periphery of the wheel F and serve as bearings for the rings, may be readily finished in a lathe or other suitable machine. Their employment is highly advantageous in that it avoids the difficulty and expense which would be incurred in finishing the hard material *h* to fit the wheel with accuracy. On each end of the shaft E we mount a box or bearing, G, and pivot to the under side thereof a screw-rod, H, which is extended downward through the main frame and provided on the under side with a strong.

spiral spring, I, and with a washer and compression-nut, J, acting below the spring, as plainly represented in Figs. 1 and 2. The springs act through the rods, the boxes, and the shaft to urge the wheels F downward strongly toward the lower surfaces of the revolving body, in order that they may act the more forcibly and efficiently in reducing the material which passes beneath the wheels. By adjusting the nut the pressure of the wheels may be increased or diminished at will.

In the treatment of materials which are readily reduced the weight of the wheels F and their shaft will be sufficient to apply the necessary crushing pressure.

While we prefer to employ the screw-rods and springs for the purpose of urging the reducing-wheels downward, we may substitute in lieu thereof weighted levers or other appliances, such as are familiar to every mechanic skilled in the art for like purposes.

In order to sustain the box G in position against the lateral pressure which will be exerted thereon when the machine is in action, we connect to each box by a ball-and-socket joint a pitman, R, which is extended forward and connected by a second ball-and-socket joint to the upright end of a rigid standard, S, bolted to the main frame. The pitmen thus applied admit of the boxes being adjusted vertically and of the two ends rising and falling independently, while at the same time they secure the shaft from being thrown forward by the resistance of the material beneath the crushing-wheels.

While the use of the ball-and-socket joint is recommended, the pitman may be connected by joints or any other known form adapted to permit the free motion of the parts.

As it is sometimes desirable to limit the downward motion of the wheels F, in order that they may be held out of contact with the surfaces *d*, so as to limit the fineness to which the material is reduced by the machine, we provide the rods H with stop devices, consisting in the present instance of nuts F′, seated thereon and arranged to bear on top of the frame.

For the purpose of discharging the material which has been reduced to the proper degree and automatically returning the coarse material to the reducing-surfaces, we locate at each end of the body an annular screen, L, of a diameter equal to or greater than the end of the body. These screens may be bolted to and revolved with the body; but it is found in practice advisable to support them independently of the body and revolve them in the opposite direction, for the reason that a more speedy and perfect separation is thereby secured. As shown in the drawings, each of these screens consists of two annular plates, *k* and *l*, connected by cross-rods *m*, and provided on the inner faces with peripheral wooden strips *n*, to which the outer surface, *o*, of wire-gauze, perforated metal, or equivalent material, is secured by means of nails, screws, or like fastening devices. The plates *k* are constructed with peripheral surfaces of true circular form, and are sustained by means of grooved rolls *p* and *q* engaging said surfaces. The lower sustaining-rolls, *p*, are mounted on the ends of two horizontal shafts, *r*, sustained in bearing-plates bolted to the base-frame. The upper rolls, *q*, revolve on vertical journals or pivots at the top of a rigid upright frame or standard, *t*. The supports for the various rolls *p* and *q* may be modified as desired, provided they are adapted to maintain the same in suitable positions.

In order to impart the rotary motion to the screens, one of the shafts *q* of the supporting-rolls is provided at the center with a pulley, *u*, connected by means of a belt, *v*, to a pulley on the shaft *r*, which carries one pair of the rolls for sustaining the body. A like arrangement of driving-belts may be used on the opposite side of the machine, if desired.

In order to prevent the outer screening-surfaces from being worn or injured by the contact of the coarse material therewith, we arrange inside thereof and at short distances therefrom a second and coarser screen, *x*, composed of perforated metal. This inner screen, which may be nailed or otherwise secured to the wooden strips before mentioned, is divided transversely at several points in its length and one end at each point of division turned inward, as shown at *w*, forming a lip or pocket, by which the coarse material lying on the inner surface is carried upward and deposited in the feed-hopper, presently to be explained. The material lodging between the screens is returned to the interior by the blocks $n^{\times}$ at the ends of the inner screen-sections. The feed-hopper is extended inward horizontally across the inner face of the screen in position to deliver the material between the inner surface, *d*, of the body and the outer surface of the crushing-wheel on the forward side of the latter. The hopper is constructed, as shown in Fig. 4, with an outlet, *y*, at the inner end, and contains in its outer end a reciprocating slide or feeder, *z*, the end of which is inclined or beveled, as shown. This slide is connected by a pitman, *a′*, to a crank or wrist pin, *b′*, mounted in a radial slot in a driving-wheel, *c′*. This construction causes a reciprocating motion to be imparted to the slide, and admits of this motion being increased or diminished by an adjustment of the crank-pin to the frame or center of the wheel. The parts are in all cases so adjusted as to stop the feed-slide in advance of the outlet-throat, the unyielding nature of the material with which the machine deals rendering this necessary in order to avoid breakage of the parts in the event of the ore lodging or becoming compacted in the throat. The slide is covered for a portion of its length at the rear end by the elevated hopper-bottom *y′*, as shown in Fig. 4. The hopper is also pro-

vided with ledges or shoulders overlapping the said edges of the slide, to prevent the material from passing downward thereunder. It is preferred to make the slide of a semicircular or V form in cross-section; but this is not essential. A vertical movable gate may be applied at the front of the slide to vary the size of the discharge-opening, and this assists in controlling the rate of feed; but this gate is not a necessary feature. As the slide recedes, the material descends by gravity in advance thereof, and as it descends it has the effect of forcing the material forward through the delivery-opening *y*, whence it descends in the path of the crushing-wheel. The beveled face of the slide is highly advantageous, first, in that it causes the vertical agitation of the mass of material, whereby it is kept in a free condition so as to feed readily, and, second, in that it avoids all danger of the material being lodged firmly in advance thereof in such manner as to endanger breakage of the parts.

In the event of the failure of the material to pass through the feed-opening the slide will pass beneath the mass and have the effect of lifting the same without danger.

We prefer to provide the bottom of the hopper with a lining of chilled iron or other refractory material, *d'*, secured in place by means of a bolt, *e'*, or other equivalent fastening device.

When operating the machine on dry material of a character which will produce light dust or powder, we propose to close the ends of the screens by means of stationary plates *f'*, and introduce through one of said plates a pipe, *g'*, one end of which is extended to the center of the machine, while the outer end is connected with a fan, a steam-jet, or other suction apparatus. The effect of this arrangement will be to produce a suction inward through the screens to the center of the machine, and thence outward through the pipe. This suction may be graduated so that it will simply have the effect of preventing dust from being thrown out of the machine, or it may be of sufficient strength to carry away the very fine material.

As an additional means of preventing the escape of dust from the machine, we propose to encircle the rotary screens with stationary sheet-metal shields or guards, as represented by dotted lines *h'* in Fig. 2.

The operation of the machine is as follows: The machine being set in motion, the body portion and crushing-wheels revolve in the same direction, as indicated by the arrows, while the screens revolve in the opposite direction. The material to be reduced, being placed in the hoppers at opposite ends, is delivered by the feed-slides *z* at a uniform rate in advance of the crushing-wheels. Descending in consequence of its gravity and of the motion of the body, the material is carried beneath the wheels and subjected to a crushing or grinding action between their lower surfaces and the inner surface, *d*, of the body. Owing to the tapered or inclined position of the surface *d*, the material is delivered automatically in rear of the crushing-wheels from the body into the descending screens. The finer material passes through the inner or coarse screens to the outer screens, through which that portion of the material reduced to the required degree escapes, while the remaining portions are carried upward with the screens and discharged thereby into the hoppers for further treatment.

While we have described above a machine having two crushing-rolls, and while for various economical reasons it is preferred to retain this construction, it is manifest that the screen, the crushing-roll, and the surface cooperating with the roll may be omitted from one end of the machine and the remaining portion operated alone.

It will be observed that, owing to the fact that the central tubular portion of the body is of smaller diameter than the ends, shoulders or flanges are formed at the inner sides of the faces *d*, to retain the material thereon and prevent it from working inward toward the central portion of the body. The central tubular portion of the body is employed in order that it may revolve about the shaft located eccentrically therein.

Having thus described our invention, what we claim is—

1. A vertically-revolving ring having its inner surface inclined transversely to effect the distribution and delivery of the material, the internal crushing-roll inclined on the periphery, the annular screen at the side of the ring to receive the material, and the elevating devices, substantially as shown, to return the material from the screen to the ring, said members combined substantially as shown.

2. In a machine for reducing refractory materials, two vertically-revolving rings united by a tubular body, in combination with an internal shaft provided with two crushing wheels or rolls arranged to act within the respective rings.

3. The revolving tubular body provided at opposite ends with the surfaces *d*, in combination with the shaft E, the wheels F thereon, and mechanism, substantially such as shown, for urging the two ends of the shaft downward independently.

4. The revolving tubular body, the rolls supporting the same, the shaft E, provided with wheels F, the boxes applied to said shaft, the vertical rods attached to the boxes, and the springs acting to urge the rods downward, said members combined for joint operation, as set forth.

5. In combination with the vertically-revolving rings or drums, the gravitating crushing-rolls therein, the roll-shaft, the boxes thereon, the rods and springs acting to urge the rolls downward, and adjustable stop de-

vices, substantially as described, to limit the approach of the rolls toward the rings.

6. In combination with the vertically-revolving ring or cylinder and an internal crushing wheel or roll, an annular screen located at the side of the ring, and mechanism, substantially as described, for imparting a rotary motion to the ring in one direction and to the screen in the opposite direction.

7. The body for a crusher having the two annular faces or tracks at opposite ends and the intermediate cylindrical portion of smaller diameter.

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Witnesses:
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GEORGE I. HILL.